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BOOK REVIEW

"SOIL BEHAVIOUR IN EARTHQUAKE GEOTECHNICS", by Kenji Ishihara, Oxford University Press, New York, N.Y. No. of pages: 350, ISBN 0-19-856224-1.

This is a timely and important book by one of the leading figures in geotechnical earthquake engineering. It is based largely on the author's 30 years of research into the behaviour of soils under cyclic loading. This research received international accolade in 1993 when Ishihara was selected to give the 33rd Rankine Lecture to the British Geotechnical Society.

The more challenging problems facing geotechnical engineers today are related to soil liquefaction, especially how to remediate potentially liquefiable sites reliably and economically. To solve these problems, engineers must be able to estimate the potential for liquefaction, the post-liquefaction stress–strain behaviour, the onset of flow deformation and the steady state or residual strength of the liquefied soils.

Probably, nothing has a greater impact on the extent and cost of remediation than the residual strength that is available to resist post-liquefaction deformations.

The determination of residual strength is a very controversial issue with at least three different procedures used in practice. The Ishihara book presents a coherent picture of the Japanese view on this matter, based largely on his own research at the University of Tokyo. The presentation, which is supported by extensive data, is a very important contribution to the debate on residual strength. It provides important support for the position that residual strength depends on both the mode of deposition of the soil and the loading path. This view is rapidly prevailing in practice in North America.

The book deals at length with the determination of liquefaction potential using *in-situ* methods such as the Standard Penetration Test, Cone Penetration Test for sands, and Large Penetration Test for gravels and geophysical methods based on correlations between shear wave velocity and liquefaction potential. Particularly useful in the context is the presentation, based on laboratory tests, of the effects of fines in the sands on liquefaction potential. There is also a very useful discussion of the quasi-steady state of silty sands. A particularly valuable contribution is the detailed discussion of the liquefaction potential of gravels. The data from cyclic loading tests on large diameter reconstituted samples of gravels, and especially on samples obtained by coring from frozen ground, constitute a unique and valuable resource. Such data are very scarce.

There is a very useful discussion of post-liquefaction settlements in the evaluation of which the author is a pioneer. He and the late Professor Seed, together with their research students, developed this aspect of geotechnical earthquake engineering almost exclusively.

The earlier part of the book discusses laboratory and *in-situ* methods for the determination of soil properties. This part of the book is more conventional in presentation. It is followed by a thorough discussion of the important dynamic characteristics of soils, low strain moduli, strain dependence of moduli and damping and the effects of rate of loading on the properties of clays. Here, as elsewhere, the discussion is enriched and illuminated by the presentation of a lot of high-quality data.

In his foreword, the author acknowledges a bias towards Japanese data and concepts. This is a source of strength in the presentation. The reader is left with a clear, uncluttered view of the current state of the art and practice in Japan, related to the effects of cyclic loading on soils and especially the problems surrounding the liquefaction phenomenon. This book deserves a careful study.

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